



# **Performance Results of CMMI with a European touch**

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André Heijstek



# Today's Talk



## SEI Overview

### Measuring Performance:

- Intro
- Dutch data
- World-wide data

### An Approach to get leading Indicators

### Conclusion



**Carnegie Mellon**  
**Software Engineering Institute**

# Software Engineering Institute

Department of Defense R&D Laboratory FFRDC

Created in 1984

Under contract to  
Carnegie Mellon University

Offices in Arlington, VA,  
Pittsburgh, PA and Frankfurt,  
Germany





# SEI's Updated Strategic Direction

## Vision

*Leading the world to a software-enriched society*

## Mission

*The SEI advances software engineering and related disciplines to ensure the development and operation of systems with predictable and improved cost, schedule, and quality.*

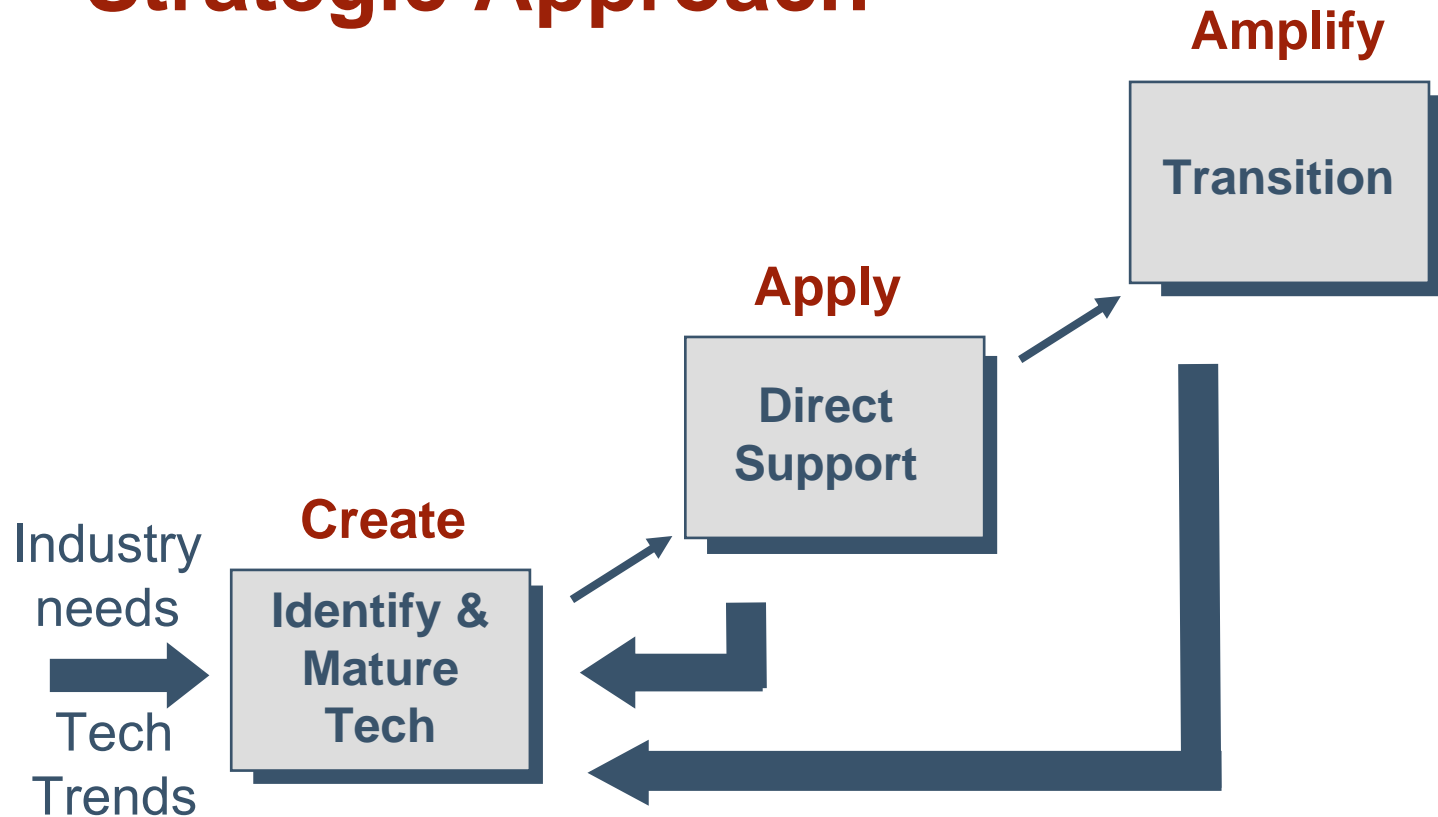
## Strategy

*To achieve its mission, the SEI strategy is to openly engage a broad-based community with a focus on improving the effects of software in the world.*

*We **create** usable technologies, **apply** them to real problems, and **amplify** their impact by accelerating broad adoption.*



# Strategic Approach





# SEI Technical Program

## **Networked Systems Survivability**

- Survivable Systems Engineering
- Survivable Enterprise Management
- CERT Coordination Center
- Network Situational Awareness
- Practices Development and Training

## **Product Line Systems**

- Product Line Practice
- Software Architecture Technology
- Predictable Assembly from Certifiable Components

## **Dynamic Systems**

- Integration of Software-Intensive Systems
- Performance-Critical Systems

## **Software Engineering Process Management**

- Capability Maturity Model Integration
- Team Software Process
- Software Engineering Measurement and Analysis

## **Acquisition Support**



# Independent R&D

## Purpose

- Discover technical ideas and concepts that lead to revolutionary improvements
- Projects become full-fledged initiatives, or inform and influence existing initiatives

## FY06 Projects

- Using Structural and Dynamic Modeling to Support Acquisition, Development, and Sustainable Deployment of Software Intensive Systems
- Organizational Risk in Architectural Design
- Certified Binaries for Software Components
- Technology for Managing Data and Data Quality in Distributed Embedded Real-Time Systems
- Technology Foundations for Computational Evaluation of Software Security Attributes
- Toward Interoperable Acquisition: The Example of Risk Management
- Measuring Attack Surfaces



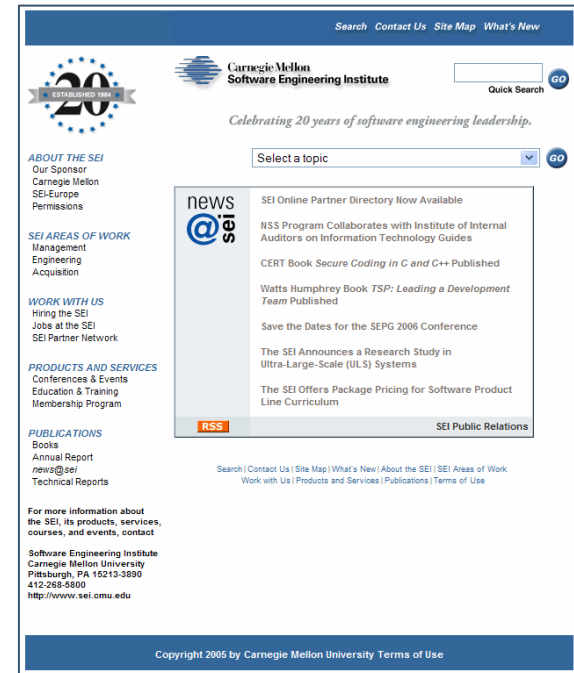
# Summary

20 years of contributions

Current technical program  
spans acquisition, technical,  
and management practices

Positioned for future challenges

- Extending current technologies
- Exploring new technologies



[www.sei.cmu.edu](http://www.sei.cmu.edu)





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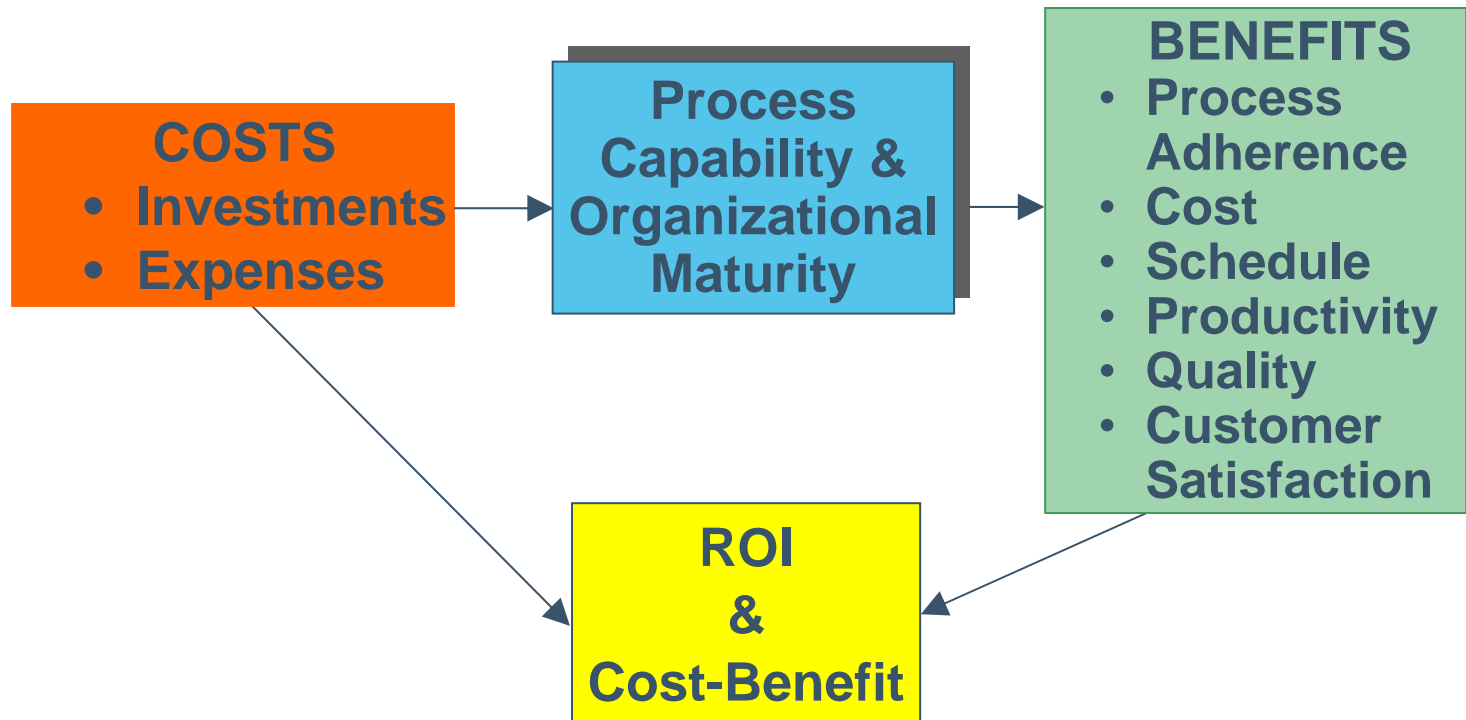
## An Approach to get leading Indicators

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# A Framework of Costs & Benefits

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# Performance Results Summary

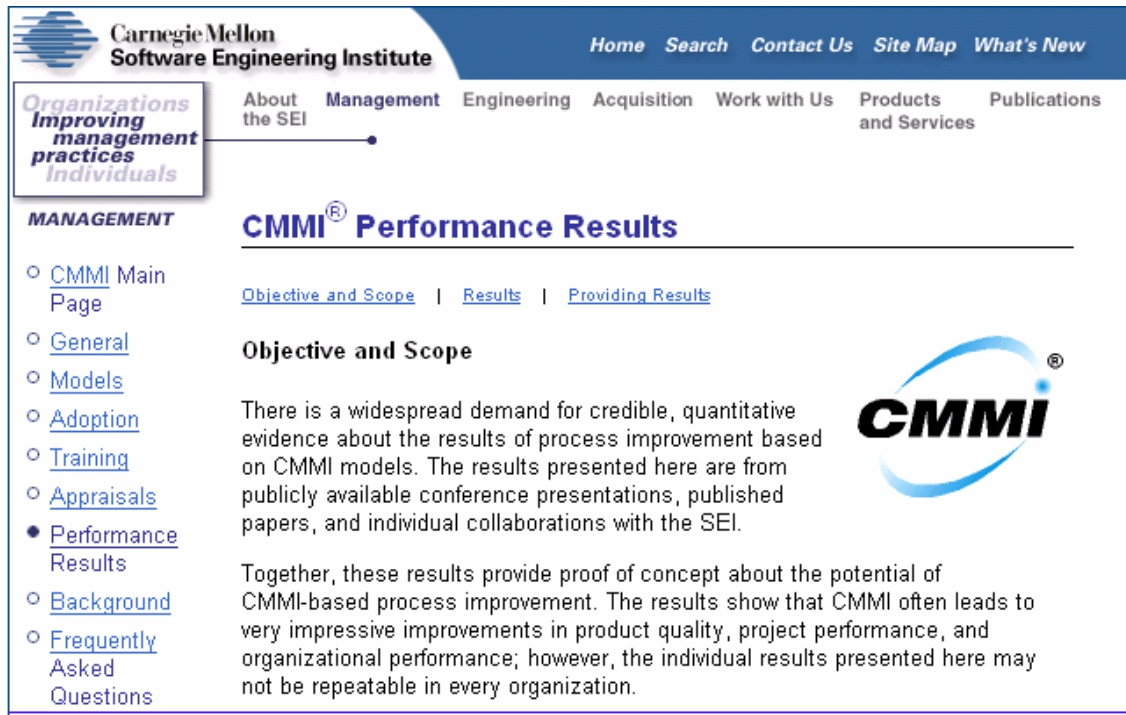
Improvements	Median	# of data points	Low	High
Cost	34%	29	3%	87%
Schedule	50%	22	2%	95%
Productivity	61%	20	11%	329%
Quality	48%	34	2%	132%
Customer Satisfaction	14%	8	-4%	55%
Return on Investment	4.0 : 1	22	1.7 : 1	27.7 : 1

- N = 30 organizations, as of June 2006
- Results expressed as change over varying periods of time

# The CMMI Performance Results Web Site

**Results by:** <http://www.sei.cmu.edu/cmmi/results.html>

- Performance category & organization
- Brief statements & graphical examples
- Full source documents



The screenshot shows the Carnegie Mellon Software Engineering Institute website. The header includes the SEI logo and navigation links: Home, Search, Contact Us, Site Map, What's New. A secondary navigation bar lists: About the SEI, Management, Engineering, Acquisition, Work with Us, Products and Services, Publications. A left sidebar contains a menu with links: CMMI Main Page, General, Models, Adoption, Training, Appraisals, Performance Results (highlighted), Background, and Frequently Asked Questions. The main content area is titled "CMMI® Performance Results" and includes sub-links: Objective and Scope, Results, and Providing Results. The "Objective and Scope" section contains two paragraphs of text and the CMMI logo.

Carnegie Mellon  
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Organizations  
Improving  
management  
practices  
Individuals

**MANAGEMENT**

- [CMMI Main Page](#)
- [General](#)
- [Models](#)
- [Adoption](#)
- [Training](#)
- [Appraisals](#)
- [Performance Results](#)
- [Background](#)
- [Frequently Asked Questions](#)


## CMMI® Performance Results

[Objective and Scope](#) | [Results](#) | [Providing Results](#)

### Objective and Scope

There is a widespread demand for credible, quantitative evidence about the results of process improvement based on CMMI models. The results presented here are from publicly available conference presentations, published papers, and individual collaborations with the SEI.

Together, these results provide proof of concept about the potential of CMMI-based process improvement. The results show that CMMI often leads to very impressive improvements in product quality, project performance, and organizational performance; however, the individual results presented here may not be repeatable in every organization.





## **CMMI<sup>®</sup> Performance Results**

### **Lockheed Martin Management and Data Systems**

The performance results examples contain brief assertion statements and their sources and sometimes are accompanied by graphic illustrations. To view the graphic or source for a statement, click the View link.

[Cost](#) | [Productivity](#) | [Customer Satisfaction](#) |

#### **Cost**

##### **Assertion Statement**

[View](#)

20 percent reduction in unit software costs as the organization integrated its engineering processes

[View](#)

15 percent decrease in defect find and fix costs as the organization integrated its engineering processes

[View](#)

4.5 percent decline in overhead rate as the organization improved from SW-CMM maturity level 3 to CMMI maturity level 5

[top](#) ▲

#### **Productivity**

##### **Assertion Statement**

[View](#)

30 percent increase in software productivity as the organization integrated its engineering processes

[top](#) ▲

#### **Customer Satisfaction**

##### **Assertion Statement**

[View](#)

Increased award fees by 55 percent compared to an earlier SW-CMM baseline at maturity level 2



## CMMI<sup>®</sup> Performance Results

### Assertion Statement Detail

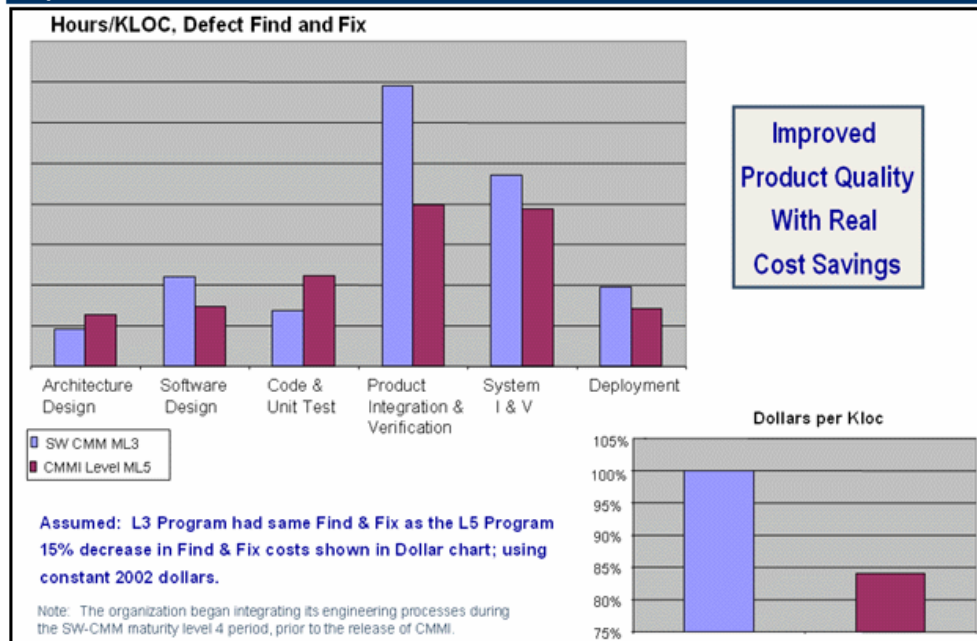
#### Statement

15 percent decrease in defect find and fix costs as the organization integrated its engineering processes

#### Organization

Lockheed Martin Management and Data Systems

#### Graphic



#### Source

Lockheed Martin Integrated Systems and Solutions. "Key Business Indicator Trends During the Journey from SW-CMM Level 2 to CMMI Level 5 at Lockheed Martin Management & Data Systems." McLoone, Peter. CMMI Technology Conference. Denver, CO, November 2003.





# Today's Talk

## SEI Overview

### Measuring Performance:

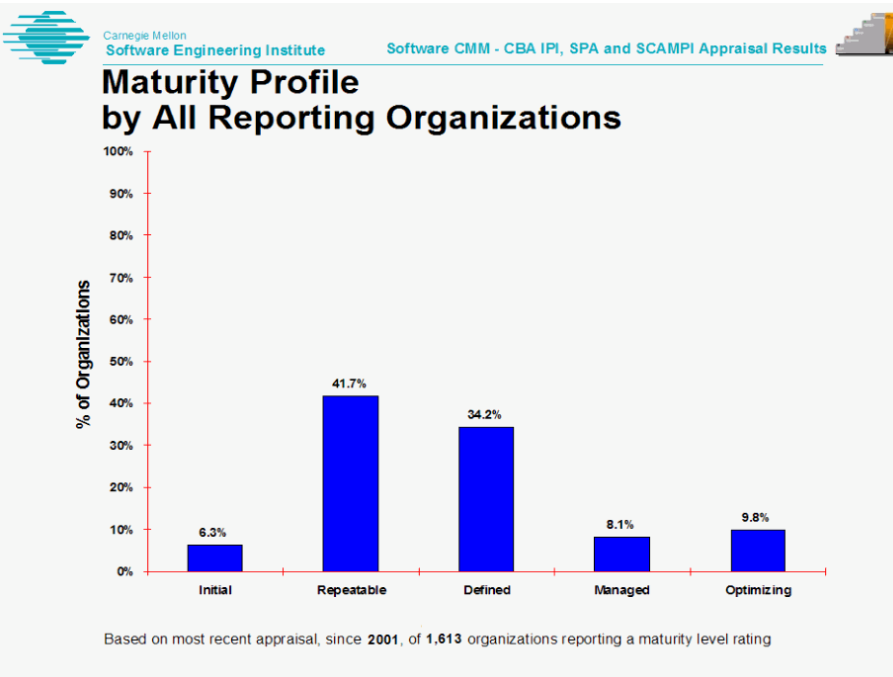
- Intro
- Dutch data
- World-wide data



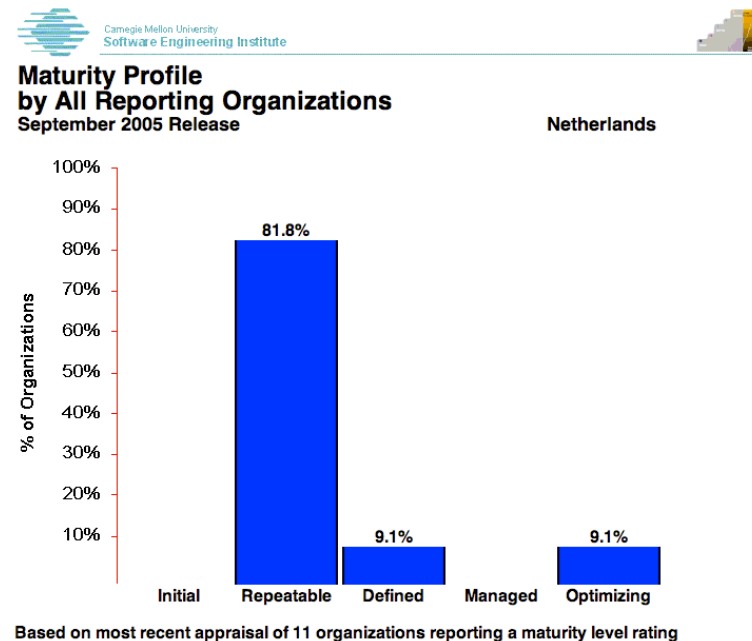
### An Approach to get leading Indicators

### Conclusion

# Some Dutch Data - for CMM



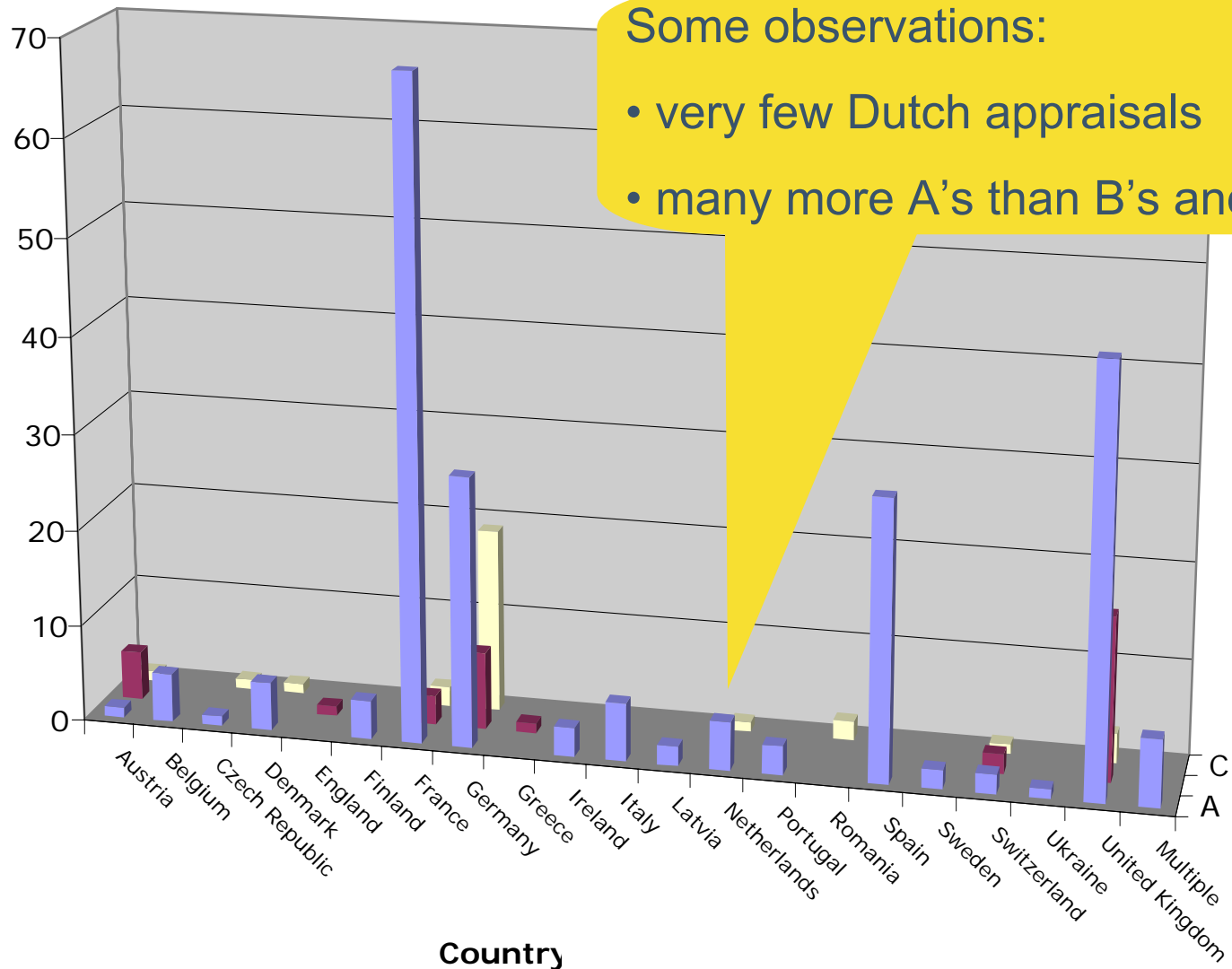
World-wide



Netherlands

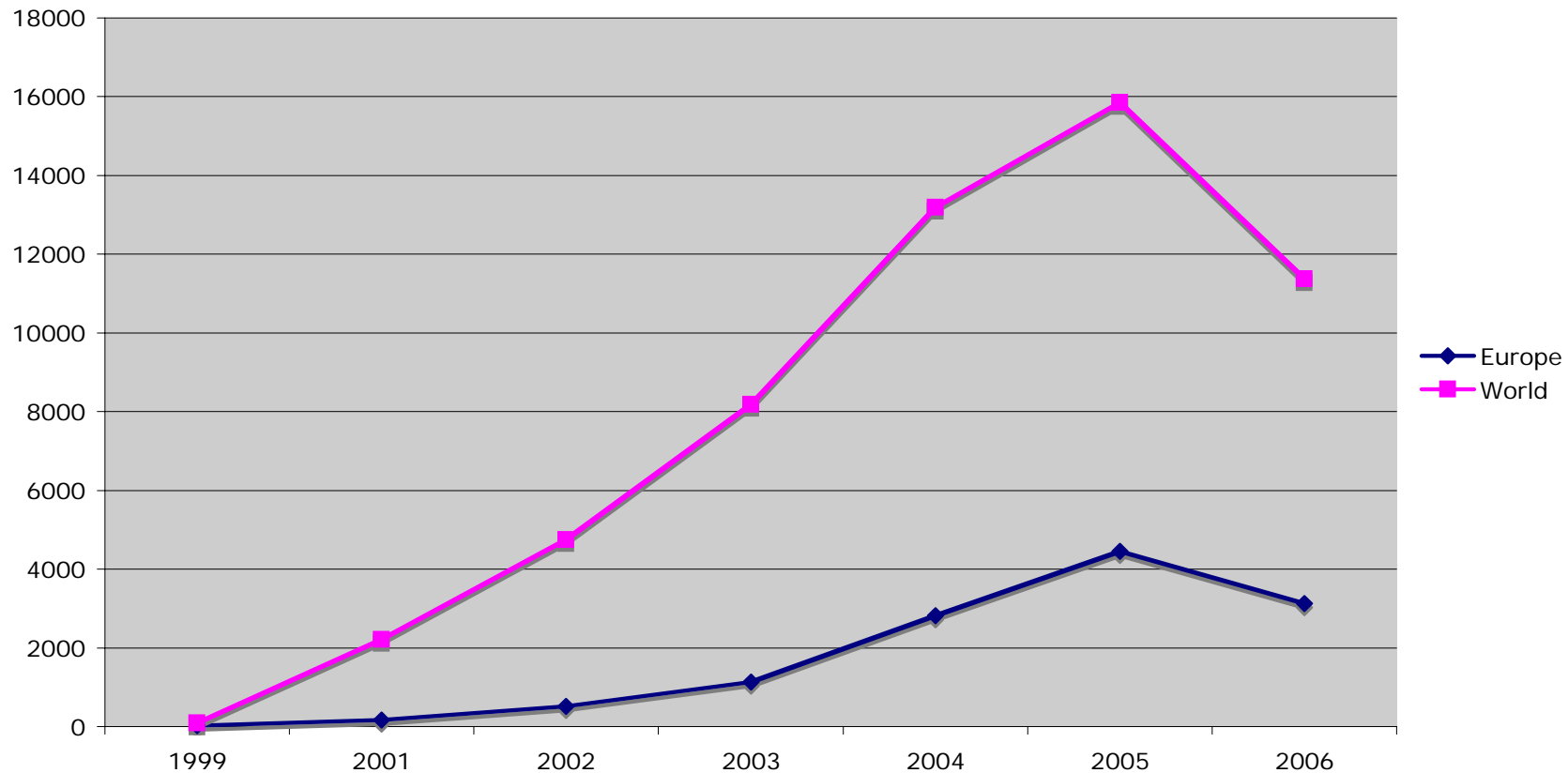


## SCAMPI Appraisals per coun





### Intro to CMMI Participants



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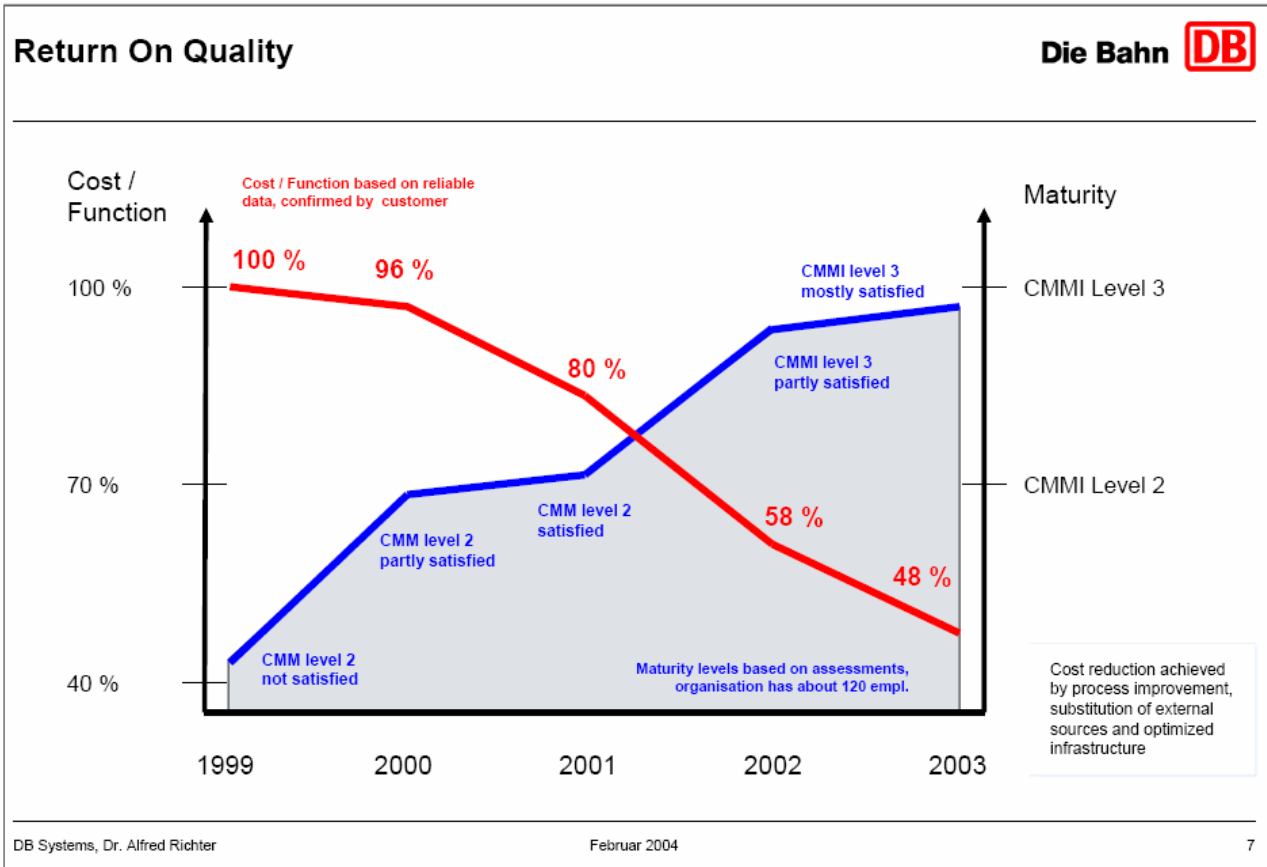
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# Performance Measure: Cost

Costs dropped 48 percent from a baseline prior to SW-CMM ML2 as the organization moved toward CMMI ML3





# Statements, Organizations at ML 2 & 3<sub>2</sub>

## Schedule

- Percentage of **milestones met** improved from approximately 50% to approximately 85% following organization focus on CMMI (General Motors)
- Average **variance** from development plan reduced from approximately 60 days to less than 20 days one year after reaching CMMI Maturity Level 2 (NCR)
- Reduced **schedule variance** over 20 percent in an organization moving towards CMMI maturity level 3 (Anonymous)
- Increased **through-put** resulting in more releases per year at CMMI maturity level 3 (JP Morgan Chase)
- Achieved 95 percent **on time delivery** in an organization moving towards CMMI maturity level 3 (Anonymous)



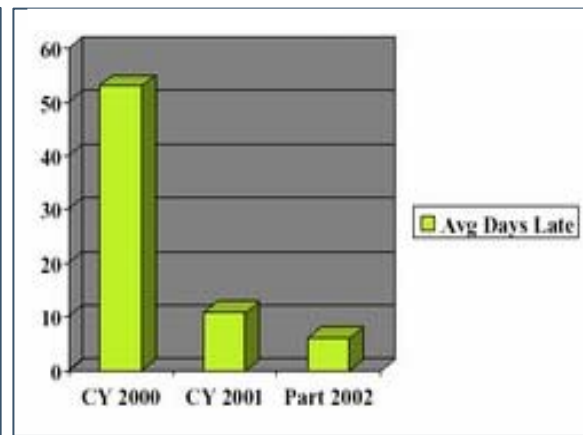
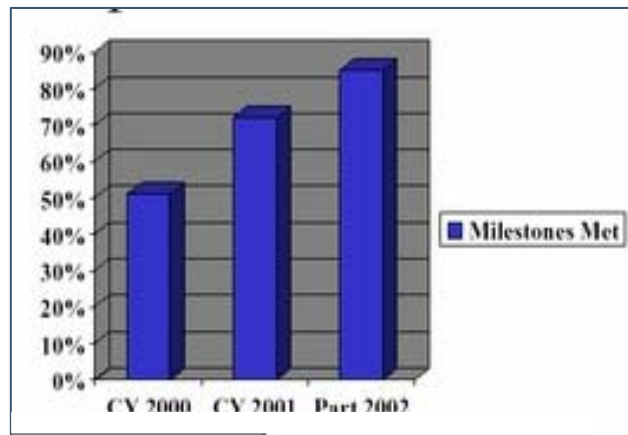
# General Motors Corporation

## CMMI focus 2001

Goal is Integration of Supplier Work and GM Project Execution

### Results:

- Improved schedule – projects met milestones and were fewer days late



Camping on a Seesaw: GM's IS&S Process Improvement Approach. Hoffman, Moore & Schatz, SEPG 2003.



# Statements, Organizations ML 2 & 3<sub>3</sub>

## Productivity

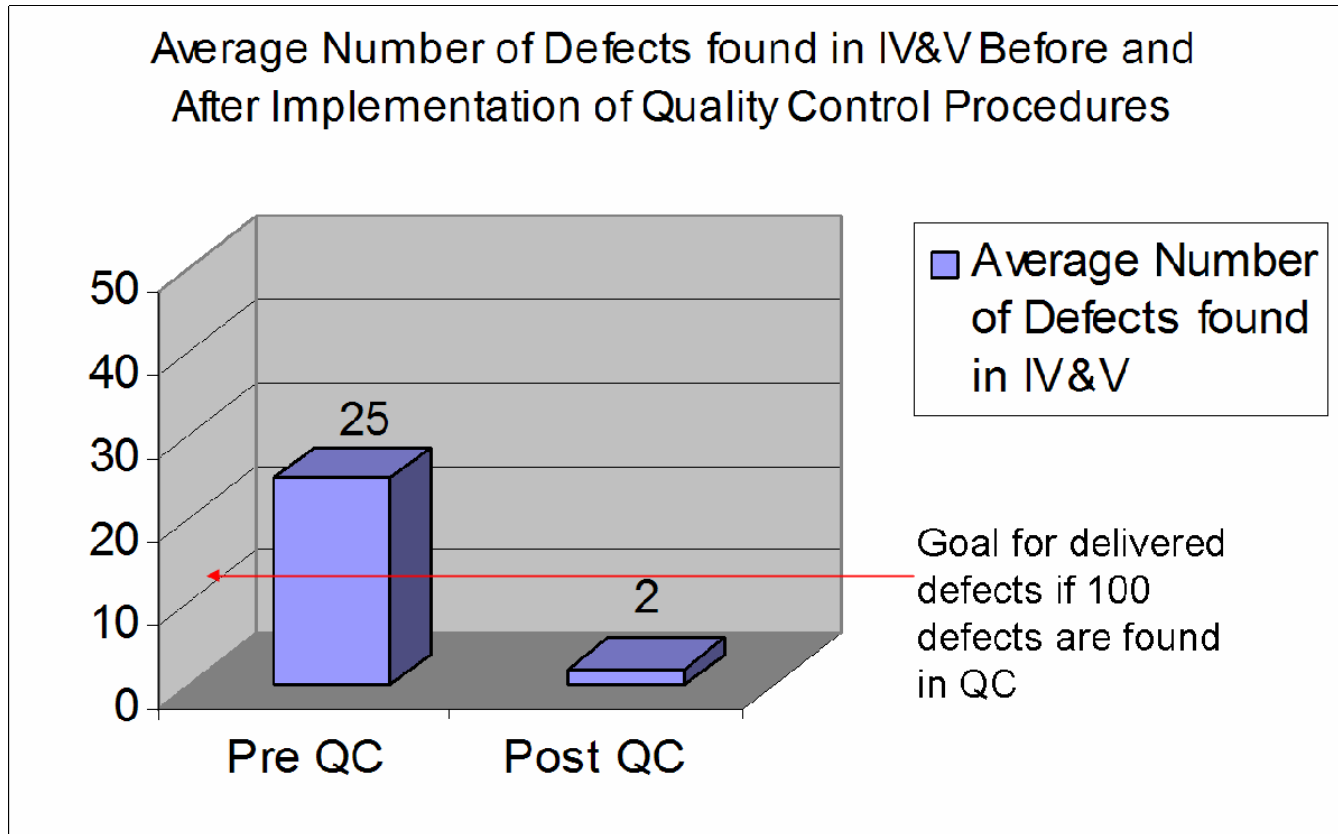
- Used Measurement & Analysis Process Area to realize an 11 percent increase in **productivity**, corresponding to \$4.4M in additional value (Anonymous)

## Quality

- Reduction in number and severity of **post release defects** at CMMI ML2 (Anonymous)
- More than 80% **drop in defects** in 6 months after achieving CMMI Maturity Level (JP Morgan Chase)
- 44% **defect reduction** following causal analysis cycle at an organization moving towards CMMI maturity level 3 (Anonymous)



# Performance Measure: Quality @ 3HT

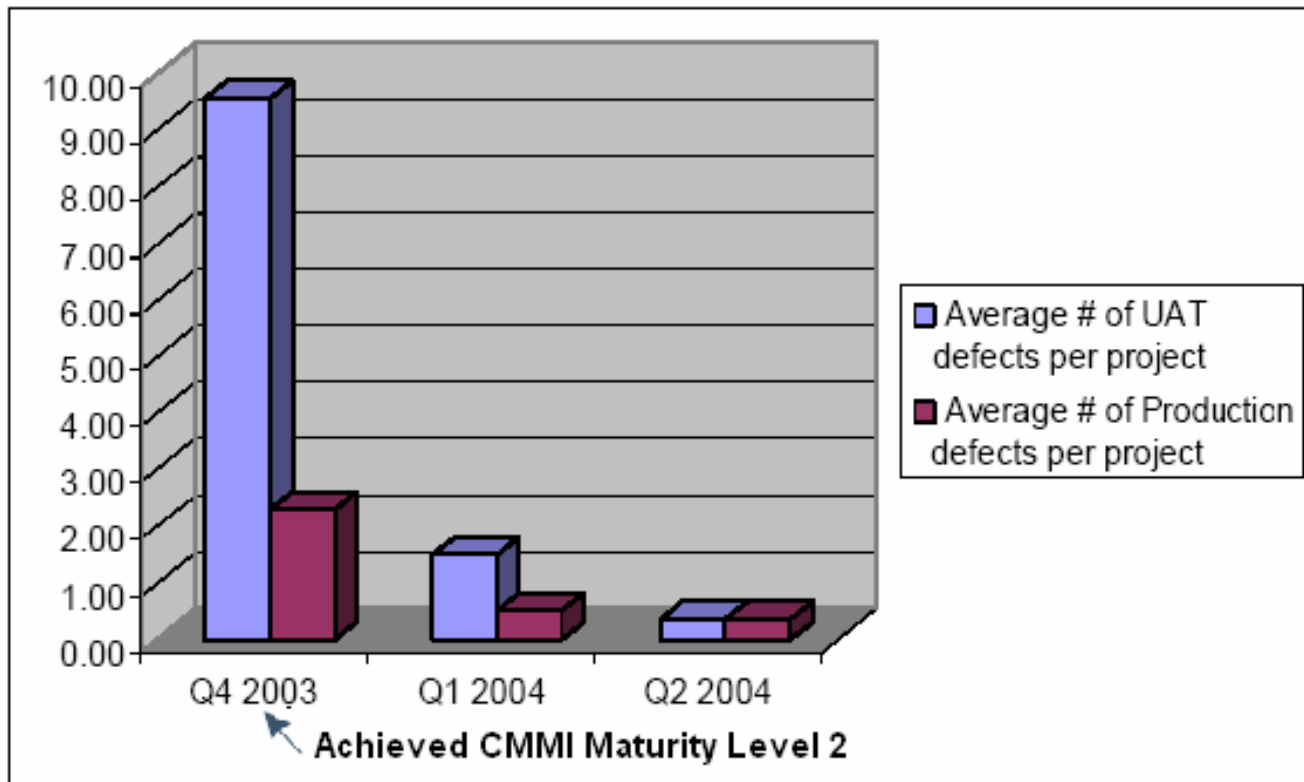






# Performance Measure: Quality

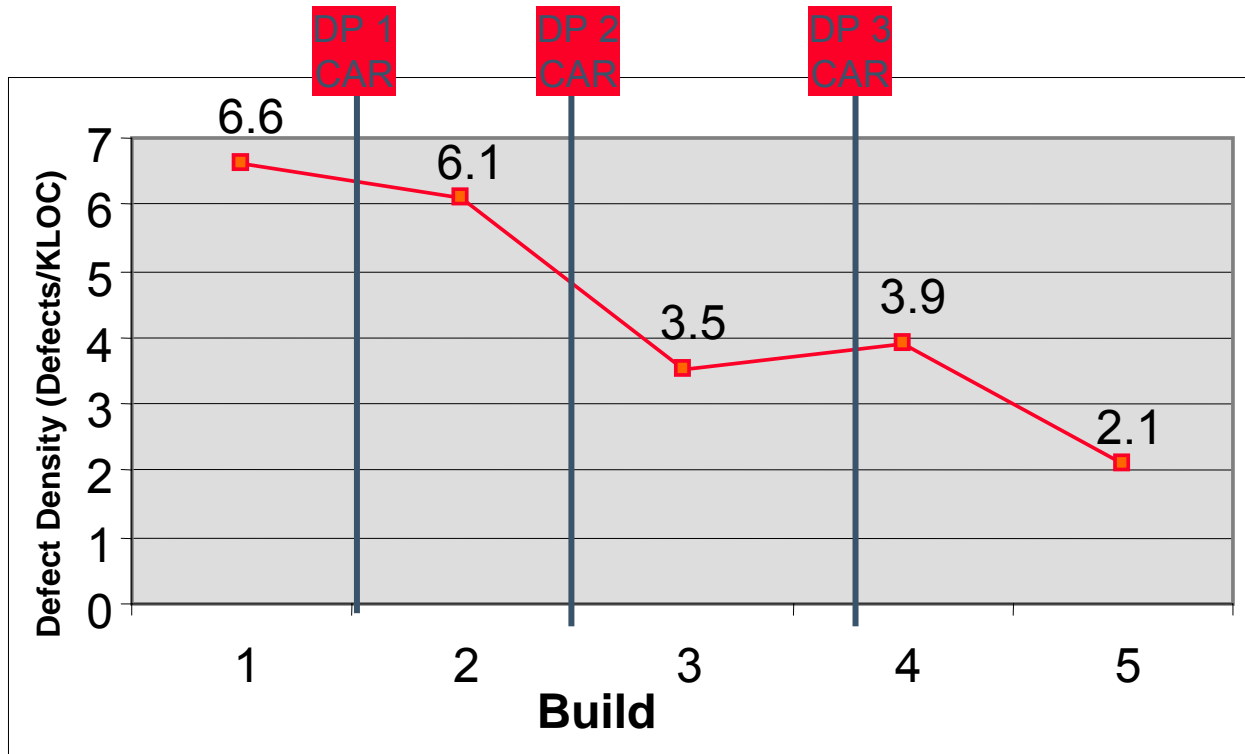
Asia Treasury and Credit Rates achieved CMMI level 2 at the end of 2003. In the subsequent 6 months their average number of UAT & production defects dropped by more than 80% (18 projects)





# Performance Measure: Quality

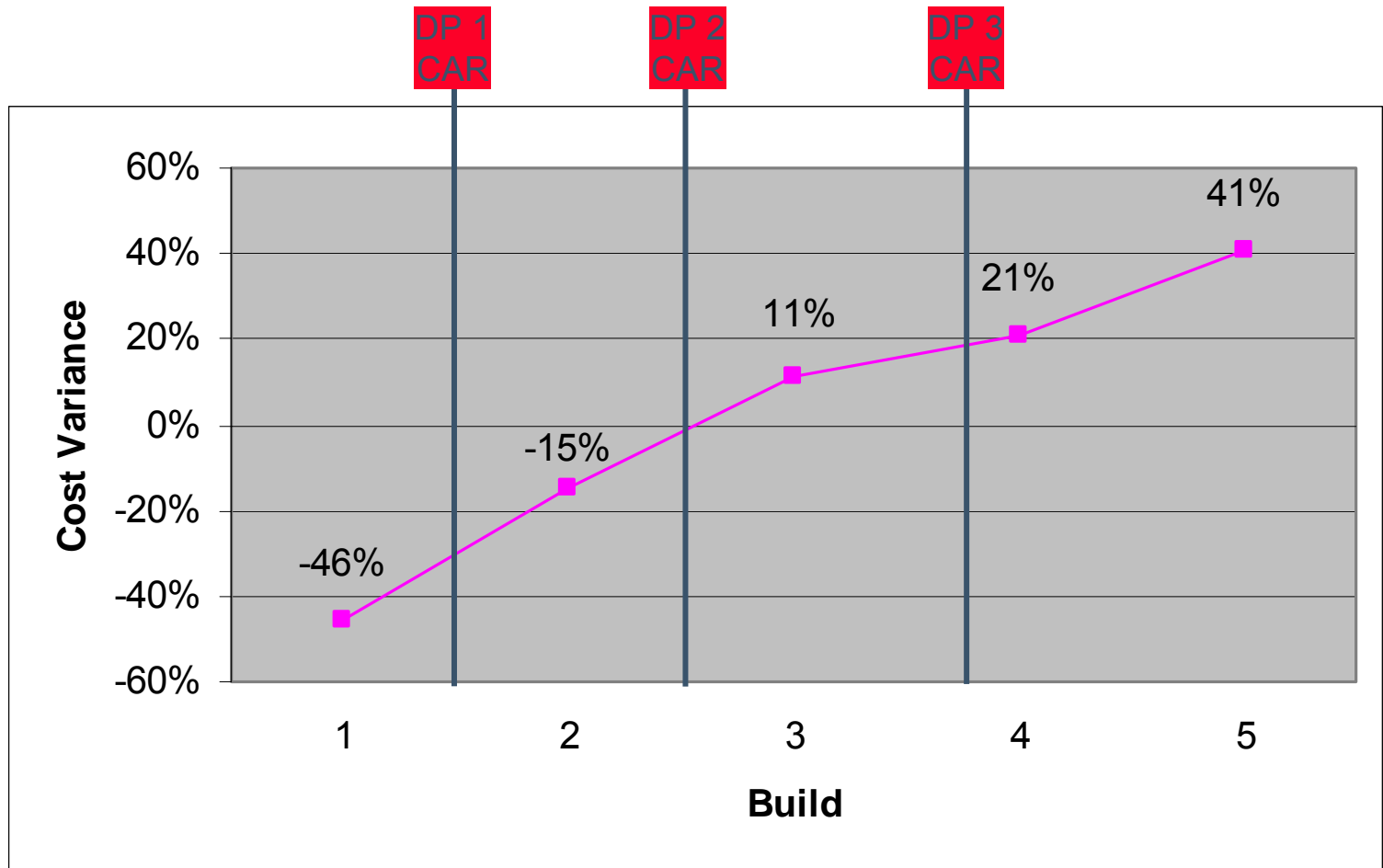
Defect prevention using PSP and CAR at CMMI ML5



Integrating PSP<sup>sm</sup> and CMMI<sup>®</sup> Level 5. Gabriel Hoffman, Northrop Grumman IT . May 1, 2003.

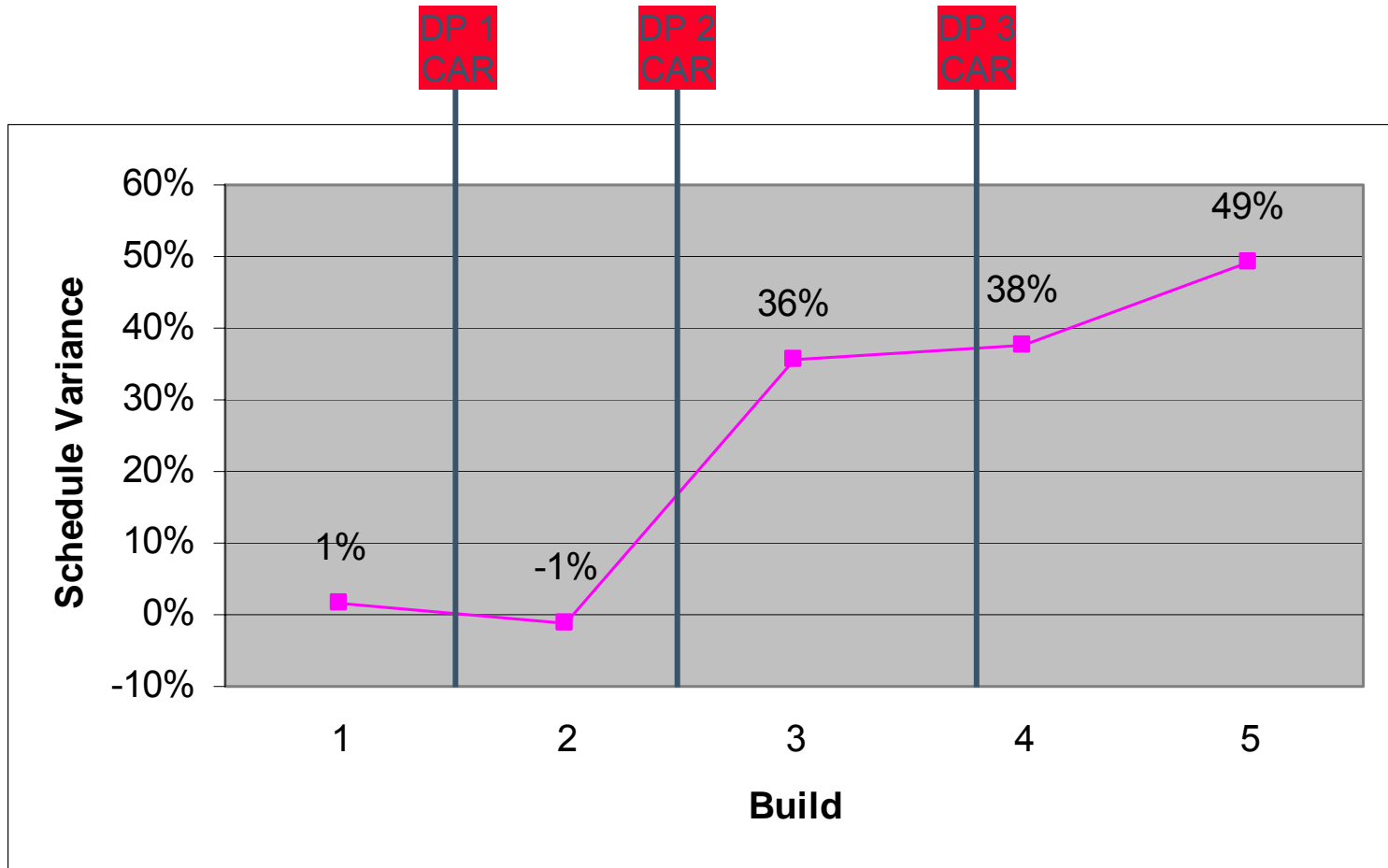


# Cost Variance by Build: NG IT



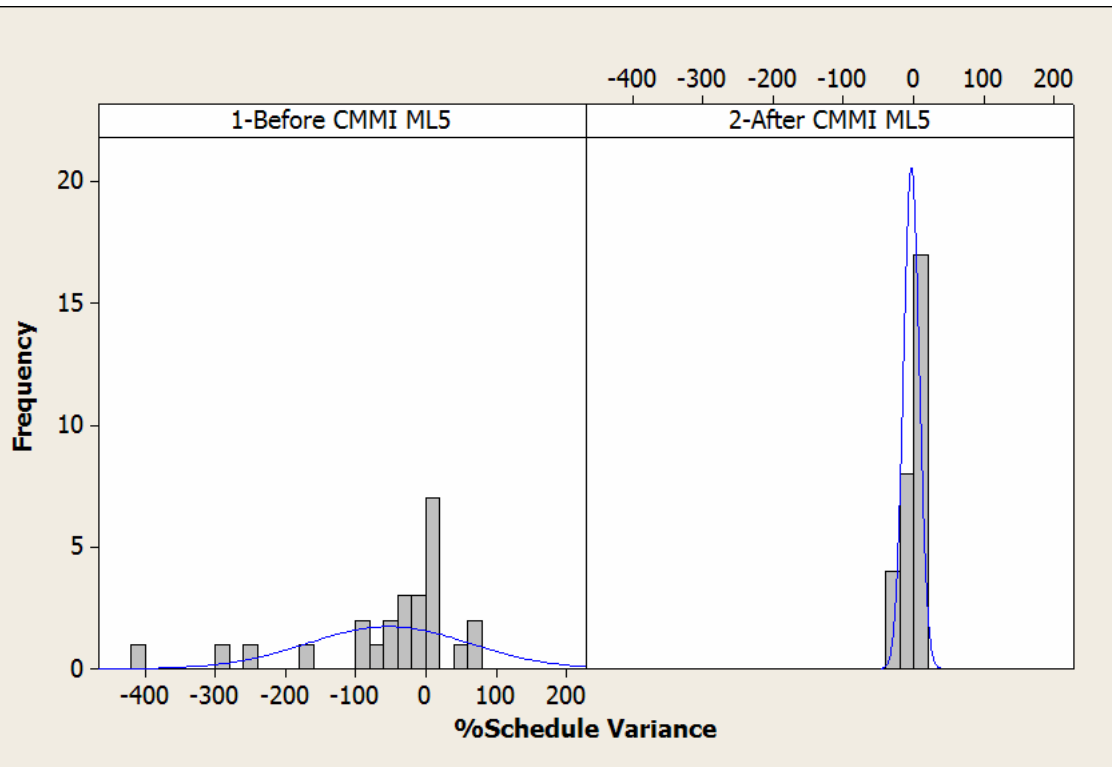


# Schedule Variance by Build: NG IT





# Warner Robins Air Logistics Center: Schedule



## Previously:

- Products delivered with considerable schedule variance

## After achieving CMMI ML5:

- Schedule variance significantly reduced
- Negative occurrences almost completely eliminated



# Remember

Don't over interpret these results out of context

- The cases differ in:
  - Organization & model scope of their process changes
  - The time span of the process or other technology interventions they report
  - The specific measures they use
  - Measures of organizational context
- Some of the results also may be atypical & exemplary

However

- They do constitute ample proof of concept of the potential of model-based process improvement



# What's Needed?

Evidence from case studies can be accused of “cherry picking” -- Fairly or not

Credible comparative evidence is sorely needed

- To better demonstrate the statistical relationships between process capability & program performance
- Controlling for other characteristics that may affect both

Empirical analyses must focus on barriers & facilitators of adoption & improvement initiatives

- Process capability doesn't always guarantee successful program performance & product quality
- Not all improvement initiatives are implemented successfully



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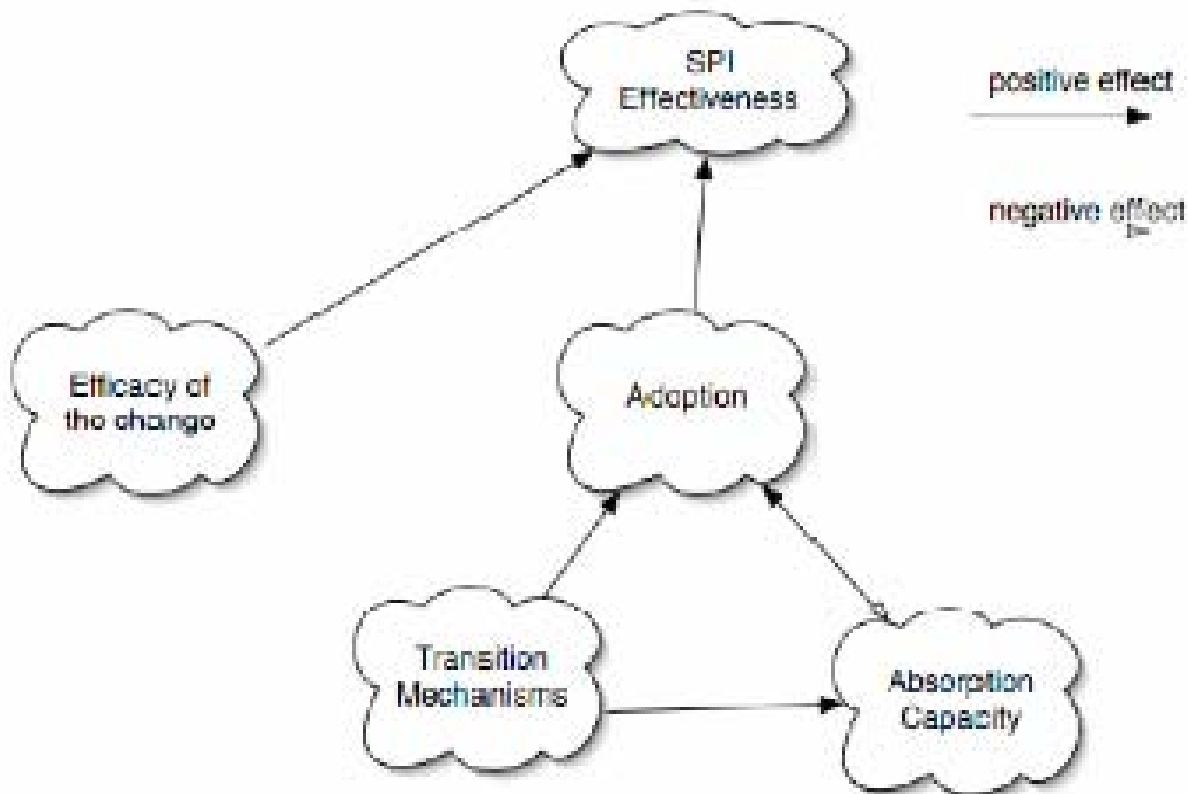
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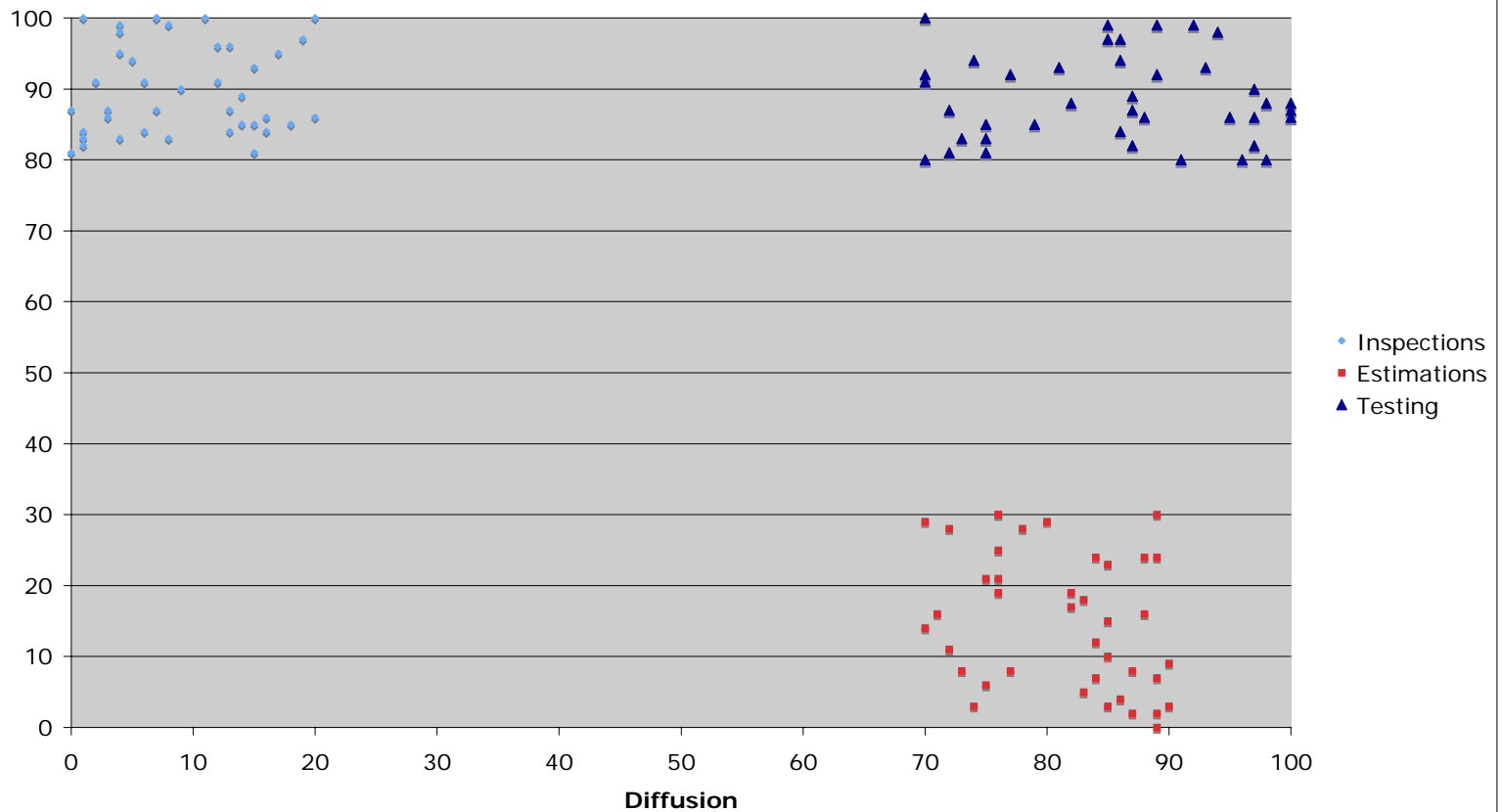


# Effects on SPI Effectiveness



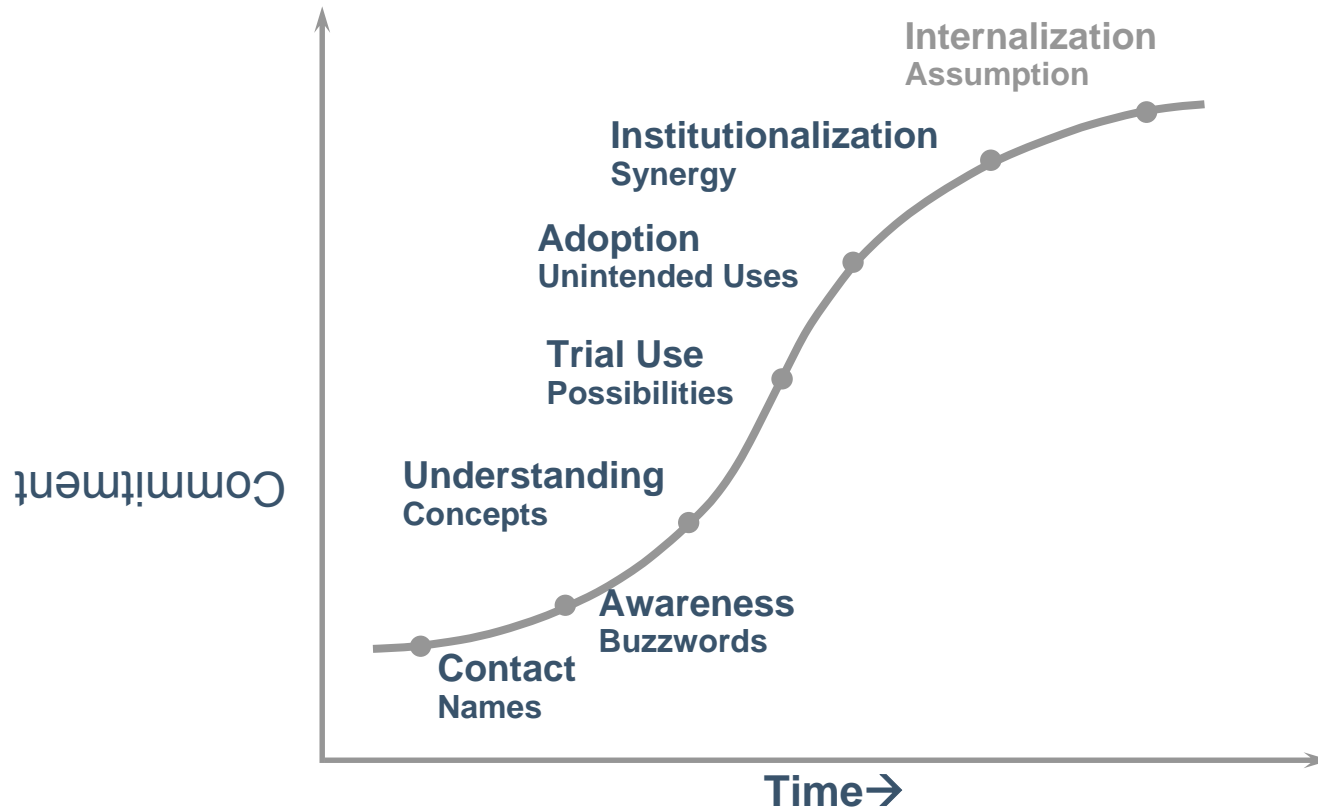


### Adoption Measurements





# Technology Adoption Commitment Curve



Adapted from Patterson & Conner, 1982 "Building Commitment to Organizational Change"

# Infusion Scale

No use	the process is not used at all
Incomplete use	not all required and/or necessary elements of the process are being performed
Ordinary use	implemented according to the book
Extensive use	implemented the spirit of the law over and above the letter of the law, integrating this process with other processes to become more efficient
Emergent use	users achieve benefits from the process(es) over and above every imagination of the process developer



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# To Summarize...

CMMI-based process improvement can and has led to notable performance outcomes

Still, we need more & better evidence

- Serious attention to benchmarking
  - Better understanding the state of the practice
  - Understanding what accounts for relative failure as well as success
- Richer case studies
- Practical guidance
  - Validating estimates and improving ROI & process models
  - Measurement, validation, data quality & analytic methods

Our bottom line: Actionable guidance using measurement to inform better decisions

# Questions?

## Some discussion items:

- In NL there are very few SEI partners, why is that?
- In NL we perform very few official SCAMPI appraisals, why is that?
- The SEI has no performance data from NL companies. Don't we collect that data, or don't we send that to the SEI?

# Reports

*Performance Results of CMMI-Based Process Improvement*, Technical Report, CMU/SEI-2006-TR-004, June 2006

*Benchmarking CMMI Cost and Impact: Interim Report*, December 2004 (Distribution of full document limited to benchmark contributors.)

*Demonstrating the Impact and Benefits of CMMI®: An Update and Preliminary Results*, Special Report, CMU/SEI-2003-SR-009, Software Engineering Institute October 2003.



# Other Publications & Presentations

## Tutorials:

- Guidance about scoping & calculating ROI analyses
- Processes & models for estimating ROI proactively
- High Maturity with Statistics
- Implementing Goal-Driven Measurement
- Managing Software Projects with Metrics
- Measuring for Performance-Driven Improvement I & II

## Conference presentations & posters

## CMMI Performance Results Web site

- <http://www.sei.cmu.edu/cmml/results.html>